# MARINE MAMMAL AND SEA TURTLE/FISHERIES INTERACTIONS IN NORTH CAROLINA

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One approach that ASMFC could examine to evaluate fisheries interactions with protected species in state waters is to 1) delineate the spatio-temporal distribution of the protected species, 2) characterize the types of gears in use by the fisheries in state waters and delineate the spatio-temporal use of these gears, and 3) determine the probability that a particular fishery takes protected species based on the coincidence in time and space of the species and fisheries. Management measures that would mitigate or decrease rates of interactions then could be implemented. Therefore, first we will discuss the distribution of turtles and marine mammals, and the physical oceanography that influences those distributions. Secondly, we will discuss strandings. Lastly, we will discuss gear in use in North Carolina, and known interactions.

There are seven species of sea turtles in the world. Five of them occur off the Atlantic seaboard of the U.S. and all five are protected under the Endangered Species Act of 1973. After spending a period of time in the pelagic environment of the open ocean, the turtles become benthic in coastal waters. Three species are found commonly in the inshore waters of the Atlantic seaboard:

loggerhead, green, and Kemp's ridley (Epperly et al. 1995*a*). Leatherbacks, at least in North Carolina, infrequently enter the inshore waters, and hawksbills are very rare.

In North Carolina inshore waters, about 80% of the turtles are loggerheads, about 15% are greens, and about 5% are Kemp's ridley turtles. In late spring these animals recruit to the estuaries and near-shore waters of the Atlantic coast. When the waters begin cooling in the fall, they migrate southward out of the temperate latitudes, at least as far south as Cape Hatteras. In the spring they will again migrate inshore and northward along the coast, repopulating inshore waters and temperate latitudes. This north-south distribution is corroborated by the facts that in the central Florida area we see turtles inshore and offshore year-round. In the Chesapeake Bay, turtles are inshore may through November, and they are absent in the winter. In Long Island turtles are inshore a lesser amount of time, June - October, and are absent in the winter. Turtles are in inshore North Carolina waters April through December but remain offshore year-round (Figure 3 in Epperly et al. 1995*a*). During the winter there is a concentration of turtles in the nearshore and offshore waters of Raleigh Bay, and few turtles in the nearshore waters to the north of Oregon Inlet and to the south of Cape Lookout.

Turtles are cold-blooded animals and their distributions are generally related to water temperature. Turtle sightings from

aerial surveys flown in the winter of 1991-1992 offshore northern North Carolina, overlayed on AVHRR imagery, demonstrates that there are very few turtles in waters less than 11° C (Table 7 in Epperly et al. 1995*b*).

The South Atlantic Bight is greatly influenced by the position of the warm, fast-moving Gulf Stream. The Raleigh Bay area is characteristically much warmer in the winter time than any other area to the south or to the north, where the continental shelf is much wider. There are two episodic physical processes working in this area. The first moves warm water into the area and the second flushes the warm water out of the area (Epperly et al. 1995*b*). The first is a shoreward movement of the Gulf Stream in the form of frontal eddies, bringing warm water ashore. During the winter, turtles are associated with the warm waters of the western wall of the Gulf Stream, and these warm-water eddies bring the turtles inshore. The second episodic process that is occurring in this area is wind. In the winter, sustained winds from the north to northeast push the cold, low salinity, Virginia Coastal Water southward around Cape Hatteras. When these winds subside, the warm waters of the Gulf Stream move shoreward. The dynamic between these two processes plays out throughout the winter.

It is along the area influenced by the Virginia Coastal Water that we see the great diversity of marine mammal strandings. From 1992-1994, 20 species of marine mammals, representing 329

individuals, stranded along the North Carolina coast. Most of the diversity in strandings occurs during the winter north of Cape Lookout.

Sixty percent of the stranded animals are Atlantic bottlenose dolphins and they strand along the coast during every month of the year. The harbor porpoise, the second most common stranded species, strands only as far south as Cape Hatteras. During 1992-1994, 26 harbor porpoises stranded between February and May. The average length of stranded harbor porpoises is 118 centimeters, or about the length at weaning. Humpback whales and harbor seals are the next most frequent species that strand. Harbor seals strand along the North Carolina coast January-April. Humpback whale strandings have been restricted to north of Cape Lookout, except for a single occurrence off Cape Fear that was found floating far offshore. They strand December through May. Thirteen animals stranded in during 1992-94; since the beginning of 1995, another four animals stranded. The average length of these animals is 837 centimeters, which is the length of an animal at weaning.

When a marine mammal strands, it is examined for evidence of human interaction. Most animals are too decomposed or not examined by experienced personnel, and, thus, a determination is not made for the majority of animals stranding. There are four categories of fishery interactions noted. The first two involve mutilation - either an animal that has been intentionally cut, or had body

parts, such as flukes, severed. The second two involve gear - either gear that is still attached to the animal, such as net or floats, or, in the absence of attached gear, clear evidence, such as cuts, that the animal had been entangled.

Most marine mammal species stranding in North Carolina show some evidence of interaction. For harbor seals, the percentage with evidence of interaction is 17%, for humpback whales it is 20%, and for harbor porpoises it is 4%. The evidence is greatest for bottlenose dolphins. There are two peaks in strandings of this species: a peak in the spring with about 26% interaction evidence and smaller peak in the fall with about 50% interaction evidence. The females are most vulnerable to these interactions just before reaching maturity, about 201 to 250 cm. The males are most vulnerable to interaction while they are still calves, less than 200 cm long.

There are two peaks in sea turtle strandings (Figure 1). The first is during the summer, and it is made up mostly of strandings from inshore waters, Onslow Bay, and Long Bay (the southern part of the state). These strandings coincides with peak activity of the trawl fishery for shrimp. The second peak, higher than the first, is made up of strandings mostly from the northern coastal area and Raleigh Bay. These strandings coincides with peak activity of the winter trawl fishery for summer flounder, the fly-net fishery for sciaenids, and the sink gill-net fishery.

Historically, a relatively small percentage of the total number of strandings during May and June have come from the northern coastal area. In 1995, from the week before Memorial Day through the first week of July, an unprecedented 105 sea turtles stranded on the northern coast. The same area experienced an average of 15 strandings over the last three years during the same time period. We do not know why animals were dying off the northern coast this year.

Sea turtles are examined also, for signs of interaction; usually a determination is not made. About 12% of all the turtles show evidence of interaction. One caution about the use of strandings data: if there are strandings and evidence of interaction, there is a problem. But, the lack of, or low number of strandings, does not mean there not a problem, because a large interaction can be occurring while carcasses are transported seaward (Epperly et al. in press).

A multitude of gears take protected species. Hook and line gear is used recreationally and commercially, in both inshore and offshore waters (Table 1). Both sea turtles and marine mammals are vulnerable to hook and line. Surface longlines set for tuna and swordfish and bottom longlines set for reef fish and sharks take sea turtles and marine mammals.

Gill nets are set in inshore and offshore waters and take sea turtles and marine mammals in both areas (Table 2). Although

incidental take by large mesh nets causes the most concern, even small mesh nets have been documented to entangle both species groups. There has been tremendous growth in the dogfish shark gill net fishery (<7 inch mesh) off the northern coast. In 1990, there were no landings reported from this fishery, but by 1994 over 9 million pounds were landed in North Carolina. The number of harbor porpoises and other marine mammals stranding off the northern coast has increased, also. Nets set for king mackerel during the fall south of Cape Hatteras take turtles, and nets set for flounder in inshore waters (usually 5 1/2 inch mesh) take turtles.

Encircling gear entraps turtles and mammals (Table 3). As long as turtles are not entangled in the net and can get to the surface to breathe, their survival rate is high. Mammals, when encircled, strike the net and frequently become entangled. Long haul seines are used in Pamlico and Core Sounds. They catch turtles and probably marine mammals, as well. Beach seines are used both in inshore and offshore waters. They are used mostly off the beaches of the northern coast. They are used, also, in the eastern Albemarle Sound, where turtle and marine mammal density is low. It is used as swipe net inside of Cape Lookout Bight. Beach seines take dolphins and probably capture turtles, too. Purse seines fish the inshore and nearshore waters througout the state. Marine mammals have been captured in purse seines; turtles probably are vulnerable, too. Stop nets are set off from Bogue Banks during

the fall. This large mesh net (8 inches) is lethal to mammals and turtles, as they get entangled in the net and are forcefully submerged. During the warm months, pound nets are set behind the barrier islands north of Beaufort Inlet; in the late winter they are set well upstream. Between 1988 and 1992, 887 turtles were captured in pound nets set in Pamlico and Core Sound by just a few reporting fishermen (Table 5 in Epperly et al. 1995*a*). Pound nets, as fished currently in North Carolina, do not appear to be a source of mortality for turtles. In the late 1960s and early 1970s, the leads of pound nets were larger (>8 inches mesh), and turtles became entangled and drowned. The mesh in the leads now is about 6-8 inches, and entanglement of turtles is rare. These same leads can entangle marine mammals.

Trawls capture turtles and, to a lesser extent, capture marine mammals (Table 4). They are used throughout the estuarine, nearshore, and offshore waters of the state. The encounter rate of turtles by shrimp trawlers has been well documented, and such trawls must now be equipped with TEDs; it also have been documented to take marine mammals, but the rate of encounter is very low. The skimmer trawl is used by the shrimp fishery, also. It probably encounters turtles at the same rate as the otter trawl, but is currently not required to used TEDs. Presumably the nets are checked frequently enough to release captured sea turtles before they drown. A channel net is a stationary trawl. It takes

turtles, but does not appear to be a source of mortality. The nets are fished frequently. The flounder fishery encounters and takes turtles at approximately the same rate as turtles are encountered in the South Atlantic shrimp fishery (Epperly et al. 1995*b*). However, in the Hatteras Bight area, turtle encounter rates are as high as 17 to 24 turtles per 100 hours of towing. In addition, in the early season, in the Hatteras Bight, 60% of the turtles caught in that fishery are Kemp's ridley sea turtles. We estimated that, during the 1991-1992 winter season, there were 1063 turtles caught in this fishery; 89 to 181 were comatose or dead. This fishery south of Cape Hatteras is operating almost exclusively in state waters. To the north it operates mostly outside the territorial seas. Beginning fall 1992, TEDs have been required in the fishery operating south of Cape Charles, and sea surface temperature data is used to manage the position of the TED line (Chester et al. 1994). There is very little observer data from the flynet fishery. Although the flynet itself does not fish on the bottom, it catches bottom-dwelling organisms. The behavior of a disturbed turtle would place it in front of the opening of the net. Thus, flynets probably are capable of taking sea turtles. Pair trawls are not listed in Table 4 because we do not know if they are used off North Carolina. They are used in the mid-Atlantic and take marine mammals. Their use in North Carolina territorial waters is prohibited.

Turtles and marine mammals get entangled in the float lines of crab pots and probably in any gear which uses floats, such as eel, shrimp, fish pots, and whelk pots (Table 5).

In summary, most gears used in North Carolina are capable of capturing protected species. The gears' efficiency at capturing these species and the likelihood of capture given the spatio-temporal distribution of the animals and the utilization of the gear must be determined. Improved communication between fishery managers, conservationists, and fishermen will go a long way in resolving and reducing these takes.

# LITERATURE CITED

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